521 M7280 – SATELLITE GEODESY

SPRING SEMESTER 2017

Lab No. 4

handed out   Wednesday, March 22, 2017
due   Wednesday, March 29, 2017, 09:10   **Name:** ______________________

Ellipsoidal Coordinate Transformations

1. Use the 3-D coordinates (xo, yo, zo) you generated in Lab 1 as ECEF coordinates to compute their coordinates:

   a. in a ellipsoidal reference frame (latitude, longitude, height)
   b. in a local Cartesian reference frame (e, n, u) (use the first point as your local origin)
   c. in a local spherical reference frame (Az, El, Sr)

   List your results in a table form with 13 columns (Pt_ID xo, yo, zo, lat, lon, ht, e, n, u, Az, El, Sr). All angles are in a degree-minute-second format.

2. Save your output from part 1a to a data file. Then write a code to read this as an input file and compute backward their ECEF coordinates (x, y, z).

   a. List your results in another table with columns (Pt_ID, xo, yo, zo, lat, lon, ht, x, y, z).
   b. Compute the difference between (xo, yo, zo) and (x, y, z), if any.

3. External check on your program (e.g., using the NGS data sheet from *www.ngs.noaa.gov*).

4. **Optional:** Repeat Part 1a, but now using a least-squares approach, see Soler et al. (2012) at *http://dx.doi.org/10.1016/j.cageo.2011.10.026*.

5. Discuss your results.

Use for $\boldsymbol{GM} = 398600.4418\left(\mathrm{km}^3/\mathrm{s}^2\right)$, $\omega_{\boldsymbol{e}}^{*} = 7292115.8553\times10^{-11}\left(\mathrm{rad/s}\right)$, $\omega_{\boldsymbol{e}} = 7292115\times10^{-11}\left(\mathrm{rad/s}\right)$, and $\boldsymbol{R} = 6371.000000\left(\mathrm{km}\right)$.

Your (individual) final report should contain (use A4 papers):

- this page as the cover sheet
- source code(s) and outputs; do not forget to add your name and lots of comment cards to the source listing (% ....)
- input and output files from program [input/output values used and calculated], if any
- plots, including captions on axes, title, your name, LB#/HM#, course title, date (if any)
- derivation and description of formulas used, accompanied by figures where applicable
- evidence of computational accuracy
- discussion of results